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Mechanics

A New Express Monitoring Method and Diagnostic Device for Determining the Efficiency of an Automotive Brake System

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(Presented by Academy Member R. Adamia)

ABSTRACT. The paper deals with a new express monitoring method and a respective diagnostic device designed for efficient performance of an automotive brake system which ensures in a short period of time, 20-25 seconds, determination of the serviceability of the brake system. The method and the device make it possible to establish and exercise regular monitoring of the brake system and exclude the putting in operation of an automobile with a faulty brake. © *2009 Bull. Georg. Natl. Acad. Sci.*

Key words: *diagnosis, express monitoring, brake system, automobile.*

Motor transport operation is characterized by an ever growing risk of sudden traffic accidents, frequently leading to sigificant human casualties and material losses of the national economy.

Hence, the subject dealt here, irrespective of its popularity, remains urgent.

The method and desk proposed by us represent a device operating under a new express failure-detection principle that is designed for determining the proper functioning of an automotive brake system [1].

The equipment/desk consists of the following components and parts (Fig. 1): rolling drums 1, upper bearing frame 2, main frame 3, rolling bearings 4, drive direct current motor (5) with support 6, point barrier 7 with a warning lamp 8, upper frame 2 with guides 9, springs 10, propeller shaft 11, spline connection 12, coupler 13, weight sensor 14, inertia governor 15, rolling drum brake 16 with frictional surface, drum brake contactor 17, point barrier 7 with magnetic drive 18, concrete foundation 19 [2].

In this case we deal with a torque system. The most popular means of formulating the equation of motion are the D'Alembert's principle and the Lagrangian method [3].

To carry out a mathematical analysis of the vehicle braking process presented on the desk it is of special importance to know the drive roll. Two options are important among the popular cases: 1) the right drum is the drive roll, i.e. the front-wheel drive; 2) both drums are drive rolls. The forces operation diagram in the case of braking the running wheel drums is presented in Fig. 2 below.

The total of moments for Option I will be:

$$M_j - P_{\text{right}} r_a = 0, \qquad (1)$$

and for Option II:

$$M_j - (P_{\text{right}} + P_{\text{left}})\, r_a = 0, \qquad (2)$$

where V_0 is speed; P_r – force to the right wheel; P_l – force to the left wheel; P – total force; R – crowding force; G_a – automobile weight; r_a – radius of automobile wheel; M_j – braking moment [4].

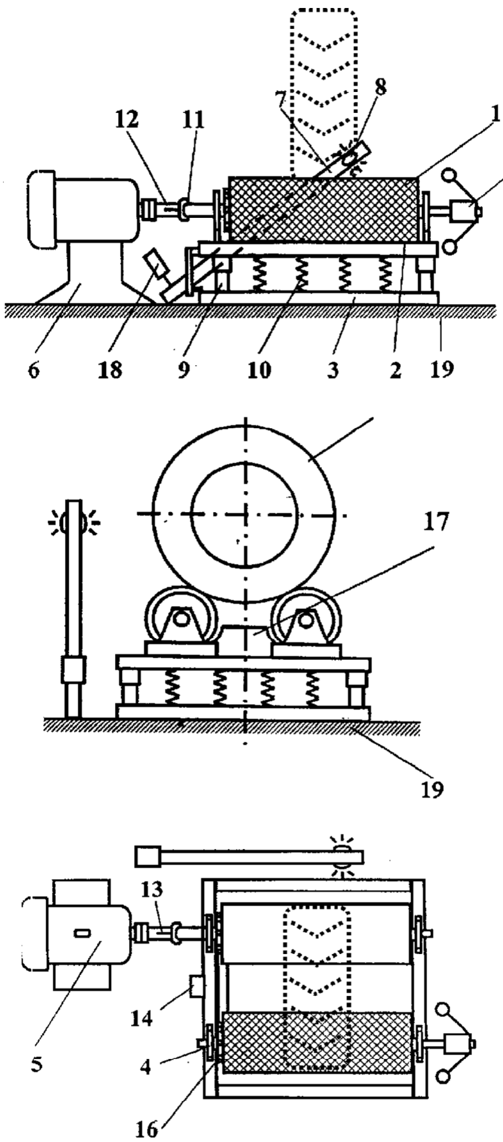

Fig. 1. Express Monitoring Diagnostic Desk.

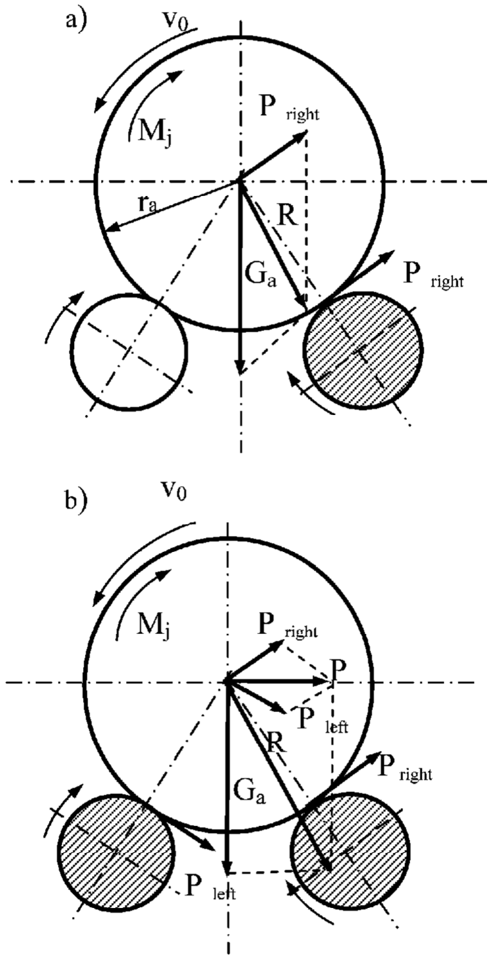

Fig. 2. Forces operation diagram during the braking of wheels
a) intertia masses on the right drum;
b) inertia masses on the right and left drums.

Conclusions.

1. The developed experimental method of monitoring efficient performance of an automotive brake system and the diagnostic device allow to check in a short period of time (20-25 sec) the performance efficiency of the automotive brake system by the generalized parameter assessment "yes' or "no", that is the monitoring method determines only the system's serviceability or unserviceability.

2. The developed express method enables first of all to determine the weight of the automobile, i.e. to assess the load falling on the running wheels by the weight sensor, also to supply electric power corresponding to the weight to the direct current motor by means of a torque rheostat, which will suffice to create a brake system.

3.The tests carried out on different automobiles have proven the accuracy of the desk-made diagnosis: when assessing the brake system for "serviceability", both efficiency parametrs – the braking distance and the slowing-down time – have been found within permissible limits, while when assessing for "unserviceability" – beyond the permissible limits.

მექანიკა

ახალი მეთოდი და დიაგნოსტიკური მოწყობილობა ავტომობილის სამუხრუჭო სისტემის ეფექტიანობის გაზომვისა და ექსპრეს-კონტროლისათვის

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ნაშრომში წარმოდგენილია ავტომობილის სამუხრუჭო სისტემის მუშაობის ეფექტურობის დადგენის ექსპრეს-კონტროლის ახალი მეთოდი და შესაბამისი დიაგნოსტიკური მოწყობილობა, რომელიც მცირე დროში (20-25 წამში) უზრუნველყოფს სამუხრუჭო სისტემის ვარგისიანობის განსაზღვრას. მეთოდითა და მოწყობილობით შესაძლებელია სამუხრუჭო სისტემაზე სისტემატური კონტროლის დამყარება, რაც გამორიცხავს უწესივრო მუხრუჭიანი ავტომობილის ექსპლუატაციაში მოხვედრას.

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